DOCUMENT RESUME

ED 142 967 CS 003 605

AUTHOR Pike, Ruth
TITLE Memory for Words and Reading Ability.
PUB DATE Mar 77
NOTE 18p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (New Orleans, March 1977)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Context Clues; *Decoding (Reading); Grade 5; Grade 6; Intermediate Grades; Memory; Psycholinguistics; *Reading Ability; Reading Instruction; *Reading Processes; *Reading Research; *Recall (Psychological); Semantics; *Serial Learning; Syntax

ABSTRACT

This paper examines the relationship between strategies for recall of verbal material and the reading ability of 10-to-13-year-old children. Sixty-five fifth and sixth graders, whose reading levels were determined by the Gates-MacGinitie Comprehension Test (1964), were given an orally presented word-string repetition task. While performance on random strings reflects verbal memory span, semantic and syntactic regularities provide cues that can facilitate performance on the other string types. Since all strings would be equally difficult without knowledge of structural possibilities and permissible word combinations of English, the differences between string types measure the extent to which available linguistic information has been used. Data for all children show that random strings were hardest and meaningful strings were easiest. While all children made some use of linguistic structure in varying degrees, good readers' perfcrmances on structured strings surpassed that of poor readers. Only for good readers did random lists show the classic serial position pattern with recency and primacy effects. Poor readers show less differentiation in their handling of random and syntactically ordered strings and tend to approach both as serial lists. The developmental implications of these results are discussed with regard to reading processes and reading instruction. (Author/RL)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED142967

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

MEMORY FOR WORDS AND READING ABILITY

by

RUTH PIKE

INSTITUTE OF CHILD STUDY

FACULTY OF EDUCATION

UNIVERSITY OF TORONTO

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Ruth Pike

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND THE ERIC SYSTEM CONTRACTORS."

Paper presented at the Biennial Meeting of the
Society for Research in Child Development
New Orleans, 1977

CS003605

This study is concerned with some differences in the way children remember lists of words and the relationship between these performance patterns and reading ability. We will show that some older grade-school children exploit linguistic structure when it is available while others do not. Good readers use the former strategy, poor readers use the latter.

My experimental paradigm was an adaptation of a simple verbal recall task that had been used both with adults (Miller and Isard, 1963) and in developmental studies (Entwisle and Frasure, 1974; Frasure and Entwisle, 1973). My procedure was similar to the earlier experiments although my materials were more varied both structurally and lexically. The lists were all six words in length, based on six different syntactic structures. There were three types of lists: meaningful grammatical sentences, anamalous sentences which retained the same phrase structure but violated standard semantic rules of English, and random lists which were formed by permuting the order of anamalous sentences.

The test was presented on tape, the words spoken without stress or intonation at the rate of one word per second. Each test tape contained 36 strings, i.e. two examples of each list-type X structures combination. The task was presented as a "game with sentences" and the child was instructed to "Say the sentence right back" after hearing it.

We tested 65 children in regular grade 5 - 6 classrooms in working-class public schools. The mean age of the children was 11.4 years and their reading levels as tested by the Gates-McGinitie Comprehension Test (1964) ranged from 2.5 to 11.6. The children I refer to as "best readers" read at one or more years above grade level, while the poorest readers all had reading scores one or more years below grade level.

The first set of resu'ts have been reported previously (Pike, reference note), so I'll just summarize briefly. We looked at the childrens' performance on each of the list types to see how many words were recalled in the correct order.

The lists, as you have heard, differ in the extent to which they contain semantic and syntactic regularities. For a subject who has knowledge of the structural possibilities of English and the acceptable word combinations, these regularities may facilitate recall. Without this knowledge, all strings should be equally difficult. Therefore, differences between list types reflect the knowledge and use of structure.

The data were remarkably consistant with regard to order of difficulty, with meaningful lists easiest and random lists hardest. There were only two deviations from this order. All of the children were able to use structure, both semantic and syntactic to help them remember. Not all children, however, used structure to the same extent. Although there were no between - group differences on the randcm lists, that is, the groups were matched for memory span, there were differences on the structured lists. The best readers benefitted more from structure than the poorest readers.

How did they use this structure? Since most of the errors were omissions, rather than permutations of order, it seemed to me that the lacilitating role of structure was not in the provision of order information. Instead, it must be related to the formation of "chunks" or recall units. One would expect then to find more evidence of such organization on the structured lists, particularly in the case of the good readers.

To examine this possibility, we calculated errors as a function of serial-list position[1] and looked at the resultant performance curves. My reasons were as follows. We know that short-term memory tasks for serially ordered but unrelated items yield a characteristic response pattern even with very young children (Huttenlocker and Burke, 1976). On the other hand, organized lists yield different curves which reflect the nature of the organization.

When multi-word recall units are formed, the words from the same unit tend to be dependant on each other for recall. As long as the subject can remember one word, he should be able to reconstruct the entire unit. The size of the unit determines the nature of the effect on the curve.

Total-list units flatten the curve. That is, as the probability of all-or-nothing recall increases, the differences between high and low points would be minimized and the curve would approach a straight line. Partial-list units cause multi-bowing and usually a change in the rank ordering of performance on the different positions. They generate relatively flat portions within the segments and steeper drops marking the transitions between units. Thus differences in the curves could indicate different grouping strategies.

Figure 1 shows the performance curves for the 20 best and 20 poorest readers.

Insert Figure 1 Here

The shapes of the random list curves of both groups are identical, the classic bow we would expect from independant items. The anomalous list

curve of the good readers has its own distinctive shape, less smooth than the standard while that of poor readers is like the random list curves. The meaningful list curves of the two groups differ from each other and from the random list curves both in smoothness and in flatness.[2]

Poor readers treat both random and syntactically ordered lists as if they are strings of independant words. Like younger children, they tend not to perceive syntactic structure in the absence of meaning (Entwisle et al, 1974). Good readers organize anomalous lists into fewer but larger recall units. Both groups of children organize meaningful lists although the poor readers may form fewer total-list units and different partial-list units than the good readers.

Because of these differences, I wondered how the units related to the structure of the sentences. To find out, we examined the results separately for each of the 24 structured lists.

Johnson (1965) noted that if grammar is used as a recoding scheme, then the nature of the recall chunks should be predictable from the structure of the material being learned. Therefore, for each potential unit, we calculated the probability that all or nothing recall would occur by chance if the words within the unit were unrelated and compared this with the actual proportional occurance of unit recall.

Table 1 shows examples of each

Insert Table 1 Here

---

type of anomalous sentence and various grammatical subdivisions. As you can see, in all but the most structually complex sentence type (Smith, 1973) the good readers formed multi-word units. These units reflected either

the surface-structural divisions of the sentence or the sentence as a whole. The poor readers on the other hand, did no chunking except in the case of the most structurally simple sentence type.

An examination of the performance on meaningful sentences as shown in Table 2 shows

---

Insert Table 2 Here

---

that even here the differences are related to syntactic competance. Both groups showed an above-chance tendency to form units at the whole sentence level. The poor readers did this to a lesser extent than the good readers particularly on the complex sentences. Both groups form some units smaller than the whole sentence. In some cases, however, the probability that the unit is one of the grammatical constituents is less than chance for the poor reader. This indicates that alternate unit divisions have been formed, divisions based on some criteria other than the usual syntactic divisions.

So my interpretation of the recall curves was confirmed and my question about the chunking pattern was answered. Good readers remember more because they organize verbal material efficiently by exploiting syntactic structure. Poor readers don't, maybe because of a delay in the development of the necessary syntactic competance. This developmental delay or difference is related both to performance on the recall task and on the reading test because both have a similar task requirement.

The process of comprehension may be described in terms of successively deeper levels of processing proceeding in the following order: phonemic, syntactic, semantic, interpretive and thematic (Perfetti, 1976). We

suggest that poor readers encounter difficulties at the school level. Neither these children, nor younger children would likely be able to analyse a sentence syntactically before processing for meaning.

Ordinarily, they wouldn't need to. In normal oral speech, supra-segmental features such as intonation, stress and irregular pause durations augment linguistic regularities and may allow the child to by-pass the syntactic level. The normal spacing of speech divides the verbal strings into syntactic or action segments. Thus, the unit size most appropriate for semantic processing is preformed for the child and immaturities are less apparent.

In our experimental materials as in graphic language, these "primary structure guides" (Steiner et al, 1971) are missing and the task of forming the appropriate multi-word unit falls on the child. Some children, as we have seen, are frequently stuck at the single-word level or else form idiosyncratic units which are not optimally efficient either for recall or reading.

The more able children have acquired an easily accessible repetoire of varied language structures which they can map or project onto verbal material which has no overt organization. This repetoire supplies ready-made encoding units which reduce the memory load on the experimental task. It also provides the basis for the phrase-unit chunking strategies that mark the transition to skilled reading (Gibson and Levin, 1975).

FOOTNOTES

[1]In our original scoring of the data, we employed a strict procedure normally used in assessing ordered recall. That is, an item was scored as correct when it was the correct item in the correct ordinal position. When there was an omission or an intrusion, not only that item but all later items were scored as incorrect, even if they were the correct items given in the correct order. The results referred to in Pike (reference note) are based on this scoring.

Since this method penalizes the final positions of the list, we rescored the data, using an adjusted scoring procedure described in Huttenlocker and Burke, (1976). This system was designed to overcome the bias inherent in the first system. The results reported in the remainder of this paper are based on the adjusted scores. Any apparent discrepancies are the result of differences in the two scoring systems.

[2]To test for effects of partial-list units, we examined the rank orders of performance on the different positions, using Page's L-statistic (Page, 1963). This procedure utilizes the ranking across positions for individual subjects. The analysis showed that the ordering of group mean results shown in Figure 1 is an accurate representation of individual results. The mean ranks and the statistical test are shown in the following table:

FOOTNOTES (Cont.)

Rank order of performance according to serial position

Group	List Type	Rank Order	L	p<
Good readers	Meaningful	1 5 4 6 3 2	1568	.01
	Anomalous	1 3 2 4 5 6	1637	.001
	Random	1 2 4 5 6 3	1639.5	.001
Poor readers	Meaningful	1 4 3 5 6 2	1757.5	.001
	Anomalous	1 2 4 5 6 3	1791.5	.001
	Random	1 2 4 5 6 3	1801.5	.001

To test for curve flatness, we used the differences between the highest and lowest position on the curve for each list type for each subject. We then compared these difference scores across groups using the Mann-Whitney U-Test: There is no difference between groups either on the random or the anamolous lists but the meaningful list curve of the good readers is flatter than that of the poor readers ($U = 106.5$, $P < .02$).

Reference Note

Pike, R. Linguistic development as a limiting factor in learning to read. Paper presented at the First Annual Boston University Conference on Language Development, 1976.

References

Entwisle, D. and Frasure, N. A contradiction resolved: Children's processing of syntactic cues. Developmental Psychology, 1974, 10, 852-857.

Francis, H. Sentence structure and learning to read. British Journal of Educational Psychology, 1972, 42, 113-119.

Frasure, N. and Entwisle, D. Demantic and syntactic development in children. Developmental Psychology, 1973, 9, 236-245.

Gates-MacGinitie Reading Tests, Survey D, Form 1, Comprehension. New York: Teachers College Press, Columbia University, 1964.

Gibson, E.J. and Levin, H. The psychology of reading. Cambridge, Mass.: The MIT Press, 1975.

Huttenlocker, J.E. and Burke, D. Why does memory span increase with ate? Cognitive Psychology, 1976, 8, 1-31.

Johnson, N.F. Sequential verbal behaviour. In T.R. Dixon and D.L. Horton (Eds.), Verbal behaviour and general behaviour theory. New York: Prentice-Hall, 1968.

Page, E.B. Ordered hypotheses for multiple treatments: A significance test for linear rands. American Statistical Association Journal, 1963, March, 216-230.

Perfetti, C.A. Language compresension and the deverbalization of intelligence. In L.B. Resnick (Ed.) The nature of intelligence. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1976.

Smith, C.S. An experimental approach to children's linguistic competance. In C.A. Ferguson and D.I. Slobin (Eds.), Studies of Child Language Development, New York: Holt, Rinehart and Winston, 1973.

Steiner, R., Wiener, M. and Cromer, W. Comprehension training and identification for poor and good readers. Journal of Educational Psychology, 1971, 62, 506-513.

TABLE 1 R. Pike

Comparison of functional response units of good vs poor readers:

anomalous lists

List Segment		Observed Probability of Units		Expected Probability if independant words
		READING LEVEL		
Total List		Good	Poor	
1	Gardens nor flies sold dark pounds	.18*	.05	.04
2	Stores hate to sleep toward picnics	.44	.28	.31
3(i)	Excellent mistakes suffer high painted fathers	.15	.00	.08
3(ii)	Hard cheap summers cry proper furs	.05	.06	.04
4	Flowers would have sailed recent chickens	.65*	.35	.35
5	None of my arts believed outside	.40*	.44*	.26
6	Green air who opens finds numbers	.26*	.13	.11
Major Constituents				
Noun Phrase				
1	Gardens nor flies	.64*	.27	.48
3(i)	Excellent mistakes	.65	.55	.74
3(ii)	Hard cheap summers	.32	.17	.34
5	None of my arts	.63	.55	.55
6	Green air	.78*	.63	.62

TABLE 1 CONTINUED

		READING LEVEL Good	Poor	
	Verb Phrase			
1	Sold dark pounds	.24	.13	.14
2	Hate to sleep toward pincics	.55*	.29	.35
3(i)	Suffer high painted fathers	.22	.06	.16
3(ii)	Cry proper furs	.13	.07	.19
4	Would have sailed recent chickens	.65	.35	.61
5	Believed outside	.69	.70	.65
6	Finds numbers	.50	.50	.60
	Minor Constituents			
	Noun Phrase			
1	Dark pounds	.48	.16	.35
3(i)	Painted fathers	.41	.19	.55
3(ii)	Proper furs	.14	.17	.38
4	Recent chickens	.79	.63	.78
	Verb Phrase			
2	Hate to sleep	.69	.63	.64
4	Would have sailed	.72	.57	.61
	Determiner Phrase			
5	None of my	.78*	.68	.62
	Embedded Clause			
6	Who opens	.53	.48	.62
	Prepositional Phrase			
2	Towards picnics	.76	.45	.77

*Different from expected probability, $p < .05$

Note: Significantly different observed probabilities are connected by lines

TABLE 1
Comparison of functional response units of

Good vs Poor readers:

List Segment		Observed probability of Units		Expected probability if independant words
Total	Sentence	Good	Poor	
1(i)	Men built a sandbox and slide	.70*----	.25	.44
(ii)	Weeks and months pass by quickly	.60	.55	.59
2	Teachers want to test clever pupils	.95*----	.60*	.77
3(i)	Better pictures showed huge grey stones	.55-----	.25	.35
3(ii)	Clean white snow covered our city	.75*----	.35	.33
4(i)	Grandpa may have missed his Train	.60*	.45	.36
(ii)	Good cooks must have measured oil	.75	.55	.58
5.**	Some of these marbles rolled away	.98	.95	
6(i)	Witnesses that lie cause needless pain	.45*----	.11	.13
(ii)	Your lady who coughed is sick	.50	.45	.42
Major constituents				
	Noun Phrase			
1(i)	Weeks and months	.80	.70*	.87
3(i)	Better picutres	.80	.65*	.86
3(ii)	Clean white snow	.80	.45*	.71
4(ii)	Good cooks	.95-----	.74*	.90
6(ii)	Your lady	.85	.85	.94
	Verb Phrase			
1(i)	Built a sandbox and slide	.70----	.25*	.49
(ii)	Pass by quickly	.65	.65	.75

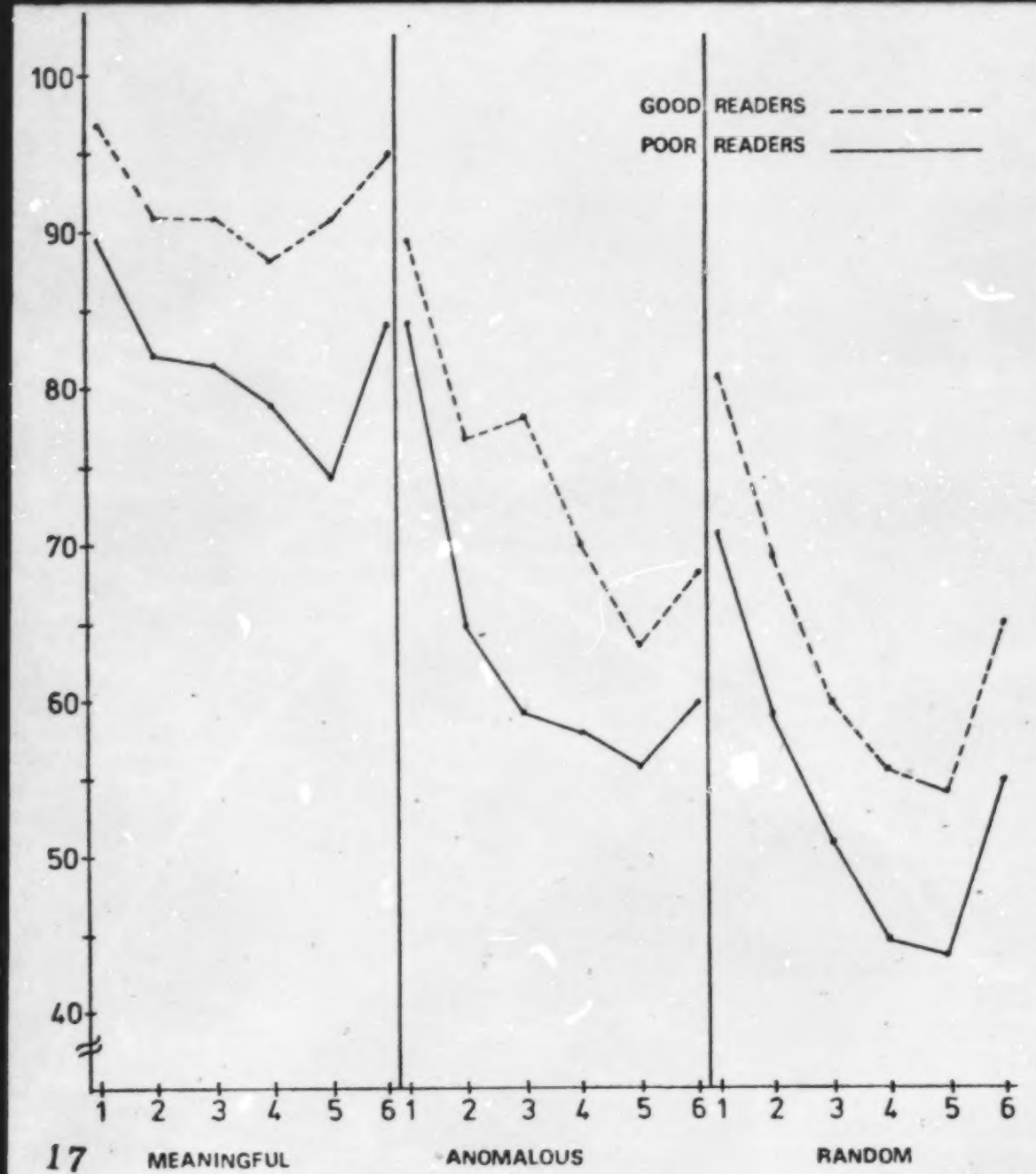
TABLE 2 CONTINUED

		Observed probability of Units		Expected probability if independant words
		Good	Poor	
2	Want to test clever pupils	.95*	.60*	.77
3(i)	Showed huge grey stones	.60	.40	.48
(ii)	Covered our city	.75	.40*	.59
4(i)	May have missed his train	.60	.47	.41
(ii)	Must have measured oil	.80	.60	.71
6(i)	Cause needless pain	.63*	.14	.37
(ii)	Is sick	1.00	.67*	.86
Minor constituents				
	Noun phrase			
1(i)	A sandbox and slide	.70	.32	.53
2	Clever pupils	.98	.68*	.90
3(i)	Huge grey stones	.68	.44	.58
(ii)	Our city	.85	.56	.76
4(i)	His train	.89	.84	.89
6(i)	Needless pain	.78	.30	.56
	Verb phrase			
2	Want to test	.98*	.88	.86
4(i)	May have missed	.63	.53	.55
(ii)	Must have measured	.80	.60	.71
	Embedded Clause			
6(i)	That lie	.65	.44	.62
6(ii)	Who caughed	.58	.59	.73

*Different from expected probability, $P < .05$

**Because of almost perfect performance on this sentence we did not examine performance on its constituents.

Note: Significantly different observed probabilities are connected by lines.



17

IGURE 1 MEAN PE CENTAGE OF CORRECT RECALL AS FUNCTION OF SERIAL POSITION

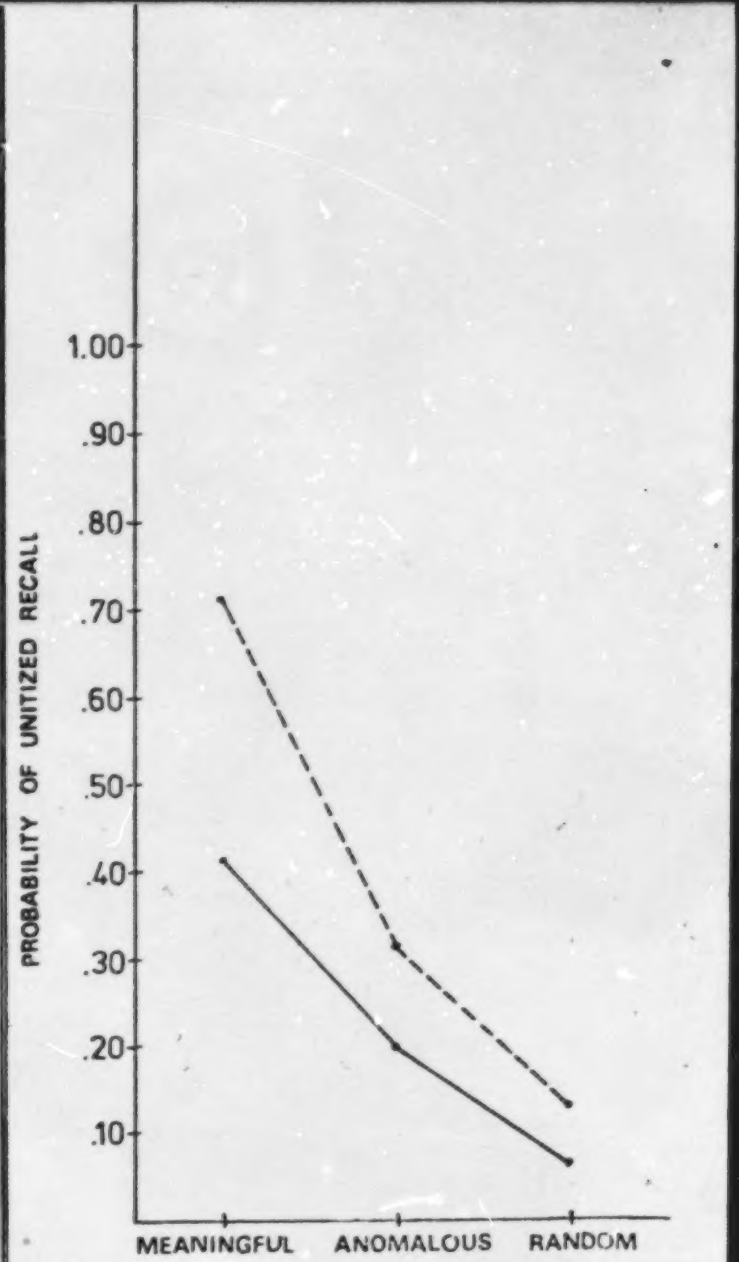


FIGURE 2 MEAN PROBABILITY THAT TOTAL LIST FUNCTIONS AS RESPONSE UNIT

18